DEPARTMENT OF THE AIR FORCE
AIR FORCE CIVIL ENGINEER CENTER
INSTALLATION RESTORATION PROGRAM
NIAGARA FALLS AIR RESERVE STATION

AFCEC/CZOE
2405 Franklin Drive
Niagara Falls, NY 14304-5063

May 12, 2022

MEMO TO: Distribution

Re: Transmittal of Final 1,4-Dioxane Sampling Work Plan, Niagara Falls Air Reserve Station, New York

Seres-Arcadis SB JV, LLC is pleased to present our Final 1,4-Dioxane Sampling Work Plan for Niagara Falls ARS, New York, Northeast Group ORC.

Sincerely,

MAIRS.LINDSAY.LEE.1589783227 Digitally signed by MAIRS.LINDSAY.LEE.1589783227 Date: 2022.05.12 11:56:14 -04'00'

LINDSAY MAIRS
Remedial Project Manager

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Mr. Steven Moeller
New York State Department of Environmental Conservation
270 Michigan Avenue
Buffalo, New York 14202

Date: May 12, 2022
Our Ref: 30036646

Subject: Final 1,4-Dioxane Sampling Work Plan
Niagara Falls Air Reserve Station
Niagara Falls, New York
Contract: W912DR-19-D-0009
Order: W912DR-19-F-0483

Dear Mr. Moeller:

On behalf of the United States Department of the Air Force, Air Force Civil Engineer Center (AFCEC) and United States Army Corps of Engineers, the SERES-Arcadis SB Joint Venture, LLC has prepared this 1,4-Dioxane Sampling Work Plan (Work Plan) for the Niagara Falls Air Reserve Station (NFARS), located in Niagara Falls, New York (Figure 1). This Work Plan proposes activities to be conducted under the Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA) process to determine if a release of 1,4-dioxane has occurred in groundwater at certain sites located within NFARS. 1,4-dioxane is considered an “emerging contaminant” by AFCEC based on changing health screening levels. In addition, 1,4-dioxane is a listed as a hazardous substance under CERCLA, which is prompting AFCEC to determine if a release has occurred and, if present, to address potential environmental releases of the contaminant resulting in unacceptable risk levels.

In August 2020, New York set a public drinking water maximum contaminant level (MCL) of 1 part per billion (ppb) or 1 microgram per liter (µg/L) for 1,4-dioxane (New York State Department of Health 2020). (The New York State Department of Environmental Conservation [NYSDEC] announced a proposed human health guidance value of 0.35 µg/L for 1,4-dioxane in groundwater and surface water in October 2021.) Currently, there is no federal regulatory cleanup level for 1,4-dioxane; however, the United States Environmental Protection Agency (EPA) has calculated a risk-based regional screening level (RSL) of 0.46 µg/L for 1,4-dioxane in tap water (USEPA, 2017). As this Work Plan is being implemented under the CERCLA process (as noted above), the data collected during this investigation will be compared to the EPA RSL of 0.46 µg/L for 1,4-dioxane in tap water (state promulgated values will not be used for delineation during this phase of work). If the proposed human health guidance value drafted by NYSDEC in October 2021 is approved by the Office of the Secretary of Defense, that value can be used to establish the scope of groundwater delineation in the remedial investigation phase of work.

This Work Plan was developed in accordance with the Interim Air Force Guidance on Sampling and Response Actions for 1,4-dioxane at Operational and Base Realignment and Closure Installations (Guidance Memorandum; Attachment A) dated August 15, 2013, which was established to promote a standardized strategy for sampling and response actions related to 1,4-dioxane. The objective of the 1,4-dioxane investigation detailed in this Work Plan is to satisfy Step One of the Guidance Memorandum, which is to assess the potential release of 1,4-dioxane at certain sites within NFARS. If 1,4-dioxane is present at levels exceeding applicable screening criteria, additional sampling may be performed.

Review of Site Status and Historical Data

Sites in remedial action operation (RA-O) or earlier phases are considered eligible for potential sampling of 1,4-dioxane. The following sites at NFARS are in RA-O or earlier phases:

- LF008 (Site 3) – Landfill
- DS004 (Site 5) – Former Boeing/Michigan Aeronautical Research Center (BOMARC) Missile Site
- DS002 (Site 8) – Former Building 202 Drum Storage Yard
- FT005 (Site 10) – Fire Training Area Number 1
- ST010 (Site 13) – Closed 4,000 Gallon Underground Storage Tank.

Next, the database was screened to determine if historical 1,4-dioxane sampling has been completed at any of these sites. Analytical results for historical 1,4-dioxane concentrations are presented in Table 1. As indicated therein, extensive sampling for 1,4-dioxane (over 400 total sample results) has been performed at the five above-listed sites since 2014. There have been only four total historical detections of 1,4-dioxane, two at Site 3 (ranging from 54.6 to 61.4 µg/L) and two at Site 5 (ranging from 104 J to 129 µg/L). However, it should be noted that the detection limits for the non-detect sample results were all greater than the EPA RSL of 0.46 µg/L and the MCL of 1 µg/L (as well as the NYSDEC proposed human health guidance value of 0.35 µg/L). As a result, the site groundwater data were further screened to determine if there were any historical validated detections of 1,1,1-trichloroethane, degradation products 1,1-dichloroethane or 1,1-dichloroethene, or trichloroethene in groundwater. Table 2 presents the historical maximum concentration of the 1,4-dioxane indicator compounds in the wells and piezometers at each site. Based on the review of the available historical site data, each of the sites were retained for sampling of 1,4-dioxane. Figures 2 through 6 present the network of existing wells and piezometers located at each of the sites.

Proposed Scope of Work

The Guidance Memorandum recommends the collection of at least three samples along the axis of the primary groundwater flow direction at each applicable site for analysis of 1,4-dioxane. These samples are typically collected from:

- One monitoring well located as close as possible to the known source of contamination (i.e., source area well);
- One monitoring well located at the downgradient limit of the impacted groundwater plume (i.e., downgradient well);
- One monitoring well located beyond the downgradient limit of the impacted groundwater plume (i.e., distal well).

Additional wells may be included if/as needed at individual sites to further characterize the presence of 1,4-dioxane. In addition to the historical analytical trends discussed above, historical geologic cross-sections (which include monitoring well construction details) and groundwater contour maps from multiple historical monitoring events were reviewed to assist with well selection at each site. Based on the review of the above-listed information, the following 1,4-dioxane sampling program is proposed for implementation at NFARS:

- LF008 (Site 3): As documented in historical reporting, the former landfill represents the potential source area at Site 3 (Figure 2). A review of the groundwater contour maps presented in the 2019 and 2020 Annual Comprehensive Sampling/Monitoring Reports indicates that the overburden groundwater flow direction at Site 3 is from northwest to southeast, toward Cayuga Creek. Similarly, bedrock groundwater flows to the southeast, with some localized variation. Those reports also noted that multiple dye tests performed previously at the Site did not provide evidence that bedrock groundwater on the eastern side of Cayuga Creek was hydraulically connected to bedrock groundwater on the western side of Cayuga Creek; however, prior groundwater data collected in piezometers located on the east side of the Creek indicate that certain constituents have been detected at levels greater than the corresponding Groundwater Protection Standards (GPS). Finally, as illustrated on Figure 2, the eastern edge of the former landfill is close to Cayuga Creek; therefore, certain modifications to the typical sampling approach specified in the Guidance Memorandum are appropriate as identification of source area, downgradient, and distal wells is not possible due to the proximity of the source area to Cayuga Creek.

Based on the above information and a review of the historical data presented in Tables 1 and 2, it is proposed to collect samples from the following wells/piezometer, which are located between the source area and Cayuga Creek and spatially distributed across the impacted groundwater plume: MW3-5D, PW3-3A, and PZ3-1D. MW3-5D was selected based on its proximity to PW3-1, which historically exhibited some of the highest concentrations of indicator compounds [similar to PW3-3A and PZ3-1D], but was previously decommissioned. In addition, it is proposed to collect samples at MW3-3DA and PZ3-7D (which have had consistent detections of cis-1,2-dichloroethene [cis-1,2-DCE] and vinyl chloride [VC] at concentrations greater than the GPS) to determine the potential presence of 1,4-dioxane in bedrock groundwater east of Cayuga Creek.

- DS004 (Site 5): As documented in historical reporting, the primary groundwater impacts at Site 5 were associated with contamination in the vicinity of former BOMARC missile launchers F5 (just north of RW5-1) and F6 (just south of MW5-5D) (see Figure 3). A review of the groundwater contour maps presented in the 2019 and 2020 Annual Comprehensive Sampling/Monitoring Reports indicates that overburden and bedrock groundwater flow in the vicinity of Site 5 is generally northeast to southwest; however, areas of localized variability (which is thought to be attributable to the presence the former BOMARC missile launchers and subsurface utilities) were also noted. Specifically, there appears to be a potentiometric ridge for overburden groundwater in the vicinity of wells RW5-2, RW5-3, RW5-4, and MW5-8, with groundwater east of this ridge flowing to the south/southeast and groundwater west of this ridge flowing to the west/southwest.

  Based on the above information and a review of the historical data presented in Tables 1 and 2, it is proposed to sample RW5-1 (which had the maximum historical concentration of 1,4-dioxane at the site and is located in close proximity to the former missile launchers) as the overburden source area well. Given the divergent overburden groundwater flow at the Site, it is proposed to sample MW5-4 and RW5-4 as downgradient overburden wells at Site 5. Finally, monitoring well MW5-5D (which had a historical detection of 1,4-dioxane and has had persistent exceedances of the GPS for cis-1,2-DCE, trans-1,2-dichloroethene, and VC) will be sampled to determine the potential presence of 1,4-dioxane in shallow bedrock groundwater near the source area. In addition, monitoring wells MW5-1DA and MW5-4D will be sampled as downgradient shallow bedrock monitoring wells.

- DS002 (Site 8): As documented in historical reporting, the former Building 202 Drum Storage Yard represents the potential source area at Site 8 (Figure 4). A review of the groundwater contour maps presented in the 2019 Annual Comprehensive Sampling/Monitoring Report (contour mapping for Site 8 was not included in the 2020 Annual Report) indicates that overburden and bedrock groundwater generally flow from northwest to southeast across Site 8, with some localized variations in overburden groundwater flow near monitoring well MW8-3 which is located north of Building 202 (see Figure 4).

Based on the above information and a review of the historical data presented in Tables 1 and 2, MW8-1 (which had the maximum historical concentrations of 1,1,1-trichloroethane [1,1,1-TCA], 1,1-dichloroethene [1,1-DCE], and trichloroethylene [TCE] at the site) is proposed as the source area well. Although a review of the historical groundwater contour maps indicates that MW8-8 may be hydraulically sidegradient to MW8-1, this well was selected for sampling as the historical data indicates this well had impacts similar to MW8-1. Finally, as there is no overburden monitoring well downgradient of MW8-1 and MW8-8 and because the hydraulic gradient is downward into bedrock, MW8-4D is proposed as the downgradient/distal well at Site 8.

- FT005 (Site 10): As documented in historical reporting, the former fire training area represents the potential source area at Site 10. Similar to Site 3, the source area at Site 10 is located in close proximity to Cayuga Creek (Figure 5). A review of the groundwater contour maps presented in the 2019 and 2020 Annual Comprehensive Sampling/Monitoring Reports indicates that the direction of overburden and bedrock groundwater flow is predominantly to the south toward Cayuga Creek. However, it appears that the area around monitoring well MW10-3 represents a highpoint in overburden groundwater, with groundwater flowing to the southeast and to the south (toward Cayuga Creek) and to the southwest (toward the drainage ditch). Similarly, the contour maps presented in the 2019 Annual Comprehensive Sampling/Monitoring Report indicates that shallow bedrock groundwater appears to flow radially outward from the area in the vicinity of monitoring well MW10-10D, while the contour map presented in the 2020 Annual Comprehensive Sampling/Monitoring Report indicates that shallow bedrock groundwater flows predominantly to the southwest away from the area around MW10-13D. A review of the deep bedrock groundwater contour maps indicates that deep bedrock groundwater flows predominantly to the south/southwest away from the area in the vicinity of MW10-1F. Finally, groundwater on the southern side of Cayuga Creek has not been found to be hydraulically connected to groundwater on the northern side of Cayuga Creek.

  Based on the above information and a review of the historical data presented in Tables 1 and 2, MW10-10D (which has had the highest historical detections of 1,1-DCE and TCE at the site) is proposed as the source area well. MW10-4D and MW10-11D are proposed as downgradient wells. Although, MW10-9D has historically had elevated concentrations of 1,1,1-TCA, this well is proposed as a downgradient/distal well since it is located south of the groundwater collection trench and there are no other bedrock wells north of Cayuga Creek. In addition, MW10-7 and MW10-4E were added as proposed sampling locations, to evaluate the potential presence of 1,4-dioxane in overburden and deep bedrock groundwater, respectively within Site 10.

- ST010 (Site 13): As documented in historical reporting, the former underground storage tank near the southeast corner of Building 904 represents the potential source area at Site 13 (Figure 6). A review of the groundwater contour maps presented in the 2019 Annual Comprehensive Sampling/Monitoring Report indicates that overburden and bedrock groundwater flow is from southwest to northeast between Buildings 904 and 912, while groundwater south of Building 912 appears to flow toward the east/southeast. The groundwater contour maps presented in the 2020 Annual Comprehensive Sampling/Monitoring Report indicates that overburden and shallow bedrock contour groundwater flow is predominantly from southwest to northeast across the site.

  Based on the above information and a review of the historical data presented in Tables 1 and 2, PW13-1 is proposed as the source area well due to the historical TCE concentrations at this well. Due to the previously noted seasonal variations in groundwater flow, both PZ13-3D and MW13-6D are proposed as downgradient wells. Further, MW13-4D is proposed for sampling due to historical cis-1,2-DCE and VC concentrations. Finally, MW13-3 is proposed for sampling to evaluate the potential presence of 1,4-dioxane in overburden groundwater based on proximity of that well to the source area.

Table 3 summarizes the proposed sampling locations and rationale for each site. The selected well locations are shown on Figures 2 through 6.

All collected groundwater samples will be submitted to ALS Environmental Laboratory, located in Middletown, New York for analysis of 1,4-dioxane by United States Environmental Protection Agency 8270 SIM. As indicated in the Basewide Quality Assurance Project Plan (QAPP; Arcadis 2021a), EPA Method 8270 SIM is one of the analytical methods recommended in the Guidance Memorandum. As noted in the QAPP, the laboratory limit of quantification (LOQ) is 0.1 µg/L and the detection limit is 0.013 µg/L. Therefore, the LOQ is less than the MCL of 1 µg/L and the EPA RSL of 0.46 µg/L (as well as the NYSDEC proposed human health guidance value of 0.35 µg/L) and will allow for conclusive determination of the potential presence of 1,4-dioxane at each site.

All field activities detailed in this Work Plan will be conducted in accordance with the procedures and standards presented in the QAPP (Arcadis 2021a) and Accident Prevention Plan (Arcadis 2021b). Further, all groundwater samples for 1,4-dioxane will be collected using low-flow sampling procedures in accordance with the sampling methodology detailed in Standard Operating Procedure E-11 – Low-Flow Groundwater Purging and Sampling Procedures for Monitoring Wells, provided in Appendix E of the Basewide QAPP (Arcadis 2021a).

Schedule and Reporting

It is anticipated that the investigation activities proposed herein will be performed in Spring 2022, following review and approval of this Work Plan by NYSDEC. A technical memorandum summarizing the field sampling activities, sample data and recommendations associated with the investigation activities proposed herein will be submitted to NYSDEC approximately 90 days following completion of the investigation activities proposed herein.

Please contact Lindsay Mairs with any questions about the information presented in this Work Plan.

Sincerely,
Arcadis U.S., Inc.

Corey R. Averill
Deputy NEORC Project Manager

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Direct Line: 315 671 9224

CC. Lindsay Mairs, AFCEC
Brett Dubner, AFCEC
Brant Crumbling, USACE
Andy Vitolins, Arcadis
Wendy Plasket, Arcadis

Enclosures:

Tables

Table 1	Historical 1,4-Dioxane Concentrations in Groundwater
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Figure 3	DS004 (Site 5) – Site Plan and Proposed Sampling Locations
Figure 4	DS002 (Site 8) -- Site Plan and Proposed Sampling Locations
Figure 5	FT005 (Site 10) – Site Plan and Proposed Sampling Locations
Figure 6	ST010 (Site 13) – Site Plan and Proposed Sampling Locations

Attachment

Attachment A	Interim Air Force Guidance on Sampling and Response Actions for 1,4-Dioxane at Operational and Base Realignment and Closure Installations

References

Arcadis. 2021a. Draft Quality Assurance Project Plan, Northeast Group Optimized Remediation Contract, Niagara Falls Air Reserve Station, New York, Contract W912DR-19-D-0009, Delivery Order W912DR-20-F-0483. May.

Arcadis. 2021b. Internal Draft Accident Prevention Plan. Northeast Group Optimized Remediation Contract, Niagara Falls Air Reserve Station, New York, Contract W912DR-19-D-0009, Delivery Order W912DR-20-F-0483. June.

New York State Department of Health. 2020. Public Water Systems and NYS Drinking Water Standards for PFOA, PFOS, and 1,4-Dioxane. August 26.

United States Environmental Protection Agency. 2017. Regional Screening Level (RSL) Summary Table. www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2016

Tables

Table 1
Historical 1,4-Dioxane Concentrations in Groundwater
1,4-Dioxane Sampling Work Plan
Niagara Falls Air Reserve Station
Niagara Falls, New York

Site	Location ID	Date	1,4-Dioxane (µg/L)
Site 3	MW3-3DA	10/23/2014	< 25
Site 3	MW3-3DA	6/24/2015	< 25
Site 3	MW3-3DA	10/27/2015	< 200
Site 3	MW3-3DA	6/30/2016	< 25
Site 3	MW3-3DA	10/25/2016	< 25
Site 3	MW3-3DA	10/25/2016	< 25
Site 3	MW3-3DA	10/30/2017	< 200
Site 3	MW3-3DA	6/26/2018	**61.4 J**
Site 3	MW3-3DA	6/18/2019	< 130
Site 3	MW3-4DA	10/23/2014	< 25
Site 3	MW3-4DA	6/24/2015	< 25
Site 3	MW3-4DA	10/27/2015	< 200
Site 3	MW3-4DA	6/30/2016	< 25
Site 3	MW3-4DA	10/25/2016	< 25
Site 3	MW3-4DA	10/30/2017	< 200
Site 3	MW3-4DA	6/26/2018	< 130 J
Site 3	MW3-4DA	6/18/2019	< 130
Site 3	PW3-3A	10/23/2014	< 25
Site 3	PW3-3A	6/24/2015	< 25
Site 3	PW3-3A	10/27/2015	< 200
Site 3	PW3-3A	6/30/2016	< 25
Site 3	PW3-3A	10/25/2016	< 25
Site 3	PW3-3A	10/30/2017	< 200
Site 3	PW3-3A	6/26/2018	< 130
Site 3	PW3-3A	6/18/2019	< 130
Site 3	PZ3-3	7/24/2014	< 25
Site 3	PZ3-3D	7/24/2014	< 25
Site 3	PZ3-6D	10/23/2014	< 25
Site 3	PZ3-6D	6/24/2015	< 25
Site 3	PZ3-6D	10/27/2015	< 200
Site 3	PZ3-6D	6/30/2016	< 25
Site 3	PZ3-6D	10/25/2016	< 25
Site 3	PZ3-6D	10/30/2017	< 200
Site 3	PZ3-6D	6/26/2018	< 130
Site 3	PZ3-6D	6/18/2019	< 130
Site 3	PZ3-7D	10/23/2014	< 25
Site 3	PZ3-7D	6/24/2015	< 25
Site 3	PZ3-7D	10/27/2015	< 200
Site 3	PZ3-7D	6/30/2016	< 25
Site 3	PZ3-7D	10/25/2016	< 25
Site 3	PZ3-7D	10/31/2017	< 200
Site 3	PZ3-7D	6/26/2018	< 130 J
Site 3	PZ3-7D	6/18/2019	< 130
Site 3	PZ3-8D	10/23/2014	< 25
Site 3	PZ3-8D	6/24/2015	< 25
Site 3	PZ3-8D	10/27/2015	< 200
Site 3	PZ3-8D	6/30/2016	< 25
Site 3	PZ3-8D	10/25/2016	< 25
Site 3	PZ3-8D	10/25/2016	< 25
Site 3	PZ3-8D	10/31/2017	< 200
Site 3	PZ3-8D	6/26/2018	< 130 J
Site 3	PZ3-8D	6/18/2019	< 130
Site 3	SW3-15	6/26/2018	**54.6 J**
Site 3	SW3-15	10/21/2019	< 130
Site 3	SW3-2	10/25/2016	< 25

Table 1
Historical 1,4-Dioxane Concentrations in Groundwater
1,4-Dioxane Sampling Work Plan
Niagara Falls Air Reserve Station
Niagara Falls, New York

Site	Location ID	Date	1,4-Dioxane (µg/L)
Site 3	SW3-2	6/26/2018	< 130 J
Site 3	SW3-2	10/21/2019	< 130 J
Site 3	SW3-3	10/25/2016	< 25
Site 3	SW3-3	6/26/2018	< 130
Site 3	SW3-3	10/21/2019	< 130 J
Site 3	SW3-15	10/25/2016	< 25
Site 5	MW5-1DA	10/23/2014	< 25
Site 5	MW5-1DA	6/24/2015	< 25
Site 5	MW5-1DA	10/27/2015	< 200
Site 5	MW5-1DA	6/29/2016	< 25
Site 5	MW5-1DA	10/25/2016	< 50
Site 5	MW5-1DA	10/30/2017	< 200
Site 5	MW5-1DA	6/25/2018	< 130 J
Site 5	MW5-1DA	10/17/2018	< 130
Site 5	MW5-1DA	6/19/2019	< 130
Site 5	MW5-1DA	10/21/2019	< 130 J
Site 5	MW5-5D	10/23/2014	< 25
Site 5	MW5-5D	10/23/2014	< 25
Site 5	MW5-5D	6/24/2015	< 130
Site 5	MW5-5D	9/2/2015	< 25
Site 5	MW5-5D	9/2/2015	< 130
Site 5	MW5-5D	10/27/2015	< 200
Site 5	MW5-5D	12/15/2015	< 200
Site 5	MW5-5D	3/22/2016	< 200
Site 5	MW5-5D	6/29/2016	< 25 J
Site 5	MW5-5D	9/29/2016	< 50
Site 5	MW5-5D	10/31/2016	< 50
Site 5	MW5-5D	10/30/2017	< 4000
Site 5	MW5-5D	6/25/2018	**104 J**
Site 5	MW5-5D	10/17/2018	< 1300
Site 5	MW5-5D	2/6/2019	< 130 J
Site 5	MW5-5D	4/17/2019	< 630 J
Site 5	MW5-5D	6/19/2019	< 130
Site 5	MW5-5D	10/21/2019	< 130 J
Site 5	MW5-6	10/23/2014	< 25
Site 5	MW5-6	6/24/2015	< 25
Site 5	MW5-6	10/27/2015	< 200
Site 5	MW5-6	6/29/2016	< 25
Site 5	MW5-6	10/25/2016	< 50
Site 5	MW5-6	10/30/2017	< 200
Site 5	MW5-6	6/25/2018	< 130 J
Site 5	MW5-6	10/17/2018	< 130
Site 5	MW5-6	10/21/2019	< 130 J
Site 5	MW5-6D	6/19/2019	< 130
Site 5	RW5-1	10/23/2014	< 25
Site 5	RW5-1	6/24/2015	< 130
Site 5	RW5-1	9/2/2015	< 630
Site 5	RW5-1	10/27/2015	< 10000
Site 5	RW5-1	12/15/2015	< 200
Site 5	RW5-1	3/22/2016	< 200
Site 5	RW5-1	6/29/2016	< 25
Site 5	RW5-1	9/29/2016	< 100
Site 5	RW5-1	10/25/2016	< 100
Site 5	RW5-1	10/30/2017	< 400
Site 5	RW5-1	6/25/2018	**129 J**

Table 1
Historical 1,4-Dioxane Concentrations in Groundwater
1,4-Dioxane Sampling Work Plan
Niagara Falls Air Reserve Station
Niagara Falls, New York

SERES Engineering & Services, LLC
ARCADIS
a joint venture

Site	Location ID	Date	1,4-Dioxane (µg/L)
Site 5	RW5-1	10/17/2018	< 130
Site 5	RW5-1	2/6/2019	< 130 J
Site 5	RW5-1	4/17/2019	< 130 J
Site 5	RW5-1	6/19/2019	< 130
Site 5	RW5-1	10/21/2019	< 130 J
Site 5	RW5-2	10/23/2014	< 25
Site 5	RW5-2	6/24/2015	< 25
Site 5	RW5-2	9/2/2015	< 25
Site 5	RW5-2	10/27/2015	< 200
Site 5	RW5-2	12/15/2015	< 200
Site 5	RW5-2	3/22/2016	< 200
Site 5	RW5-2	6/29/2016	< 25
Site 5	RW5-2	9/29/2016	< 100
Site 5	RW5-2	10/25/2016	< 50
Site 5	RW5-2	10/30/2017	< 200
Site 5	RW5-2	6/25/2018	< 130 J
Site 5	RW5-2	10/17/2018	< 130
Site 5	RW5-2	2/6/2019	< 130 J
Site 5	RW5-2	2/6/2019	< 130
Site 5	RW5-2	4/17/2019	< 130 J
Site 5	RW5-2	6/19/2019	< 130
Site 5	RW5-2	10/21/2019	< 130 J
Site 5	RW5-4	10/23/2014	< 25
Site 5	RW5-4	6/24/2015	< 25
Site 5	RW5-4	9/3/2015	< 25
Site 5	RW5-4	10/27/2015	< 10000
Site 5	RW5-4	12/15/2015	< 20000 R
Site 5	RW5-4	3/22/2016	< 200
Site 5	RW5-4	6/29/2016	< 25
Site 5	RW5-4	9/29/2016	< 100
Site 5	RW5-4	10/25/2016	< 25
Site 5	RW5-4	10/25/2016	< 50
Site 5	RW5-4	10/30/2017	< 200
Site 5	RW5-4	6/25/2018	< 130
Site 5	RW5-4	10/17/2018	< 130
Site 5	RW5-4	2/6/2019	< 130 J
Site 5	RW5-4	4/17/2019	< 130 J
Site 5	RW5-4	6/19/2019	< 130
Site 5	RW5-4	10/21/2019	< 130
Site 8	MW8-1	10/23/2014	< 25
Site 8	MW8-1	6/24/2015	< 25
Site 8	MW8-1	8/28/2015	< 25 J
Site 8	MW8-1	10/27/2015	< 200
Site 8	MW8-1	12/15/2015	< 200
Site 8	MW8-1	3/22/2016	< 200
Site 8	MW8-1	6/29/2016	< 25
Site 8	MW8-1	9/29/2016	< 200
Site 8	MW8-1	10/25/2016	< 50
Site 8	MW8-1	10/30/2017	< 200
Site 8	MW8-1	2/12/2018	< 400
Site 8	MW8-1	4/26/2018	< 130
Site 8	MW8-1	6/25/2018	< 130 J
Site 8	MW8-1	10/17/2018	< 130
Site 8	MW8-1	2/6/2019	< 130
Site 8	MW8-1	4/17/2019	< 130 J

Table 1
Historical 1,4-Dioxane Concentrations in Groundwater
1,4-Dioxane Sampling Work Plan
Niagara Falls Air Reserve Station
Niagara Falls, New York

SERES Engineering & Services, LLC
ARCADIS
a joint venture

Site	Location ID	Date	1,4-Dioxane (µg/L)
Site 8	MW8-1	6/18/2019	< 130
Site 8	MW8-1	10/21/2019	< 130 J
Site 8	MW8-10D	10/23/2014	< 25
Site 8	MW8-10D	6/24/2015	< 25
Site 8	MW8-10D	9/1/2015	< 25
Site 8	MW8-10D	10/27/2015	< 200
Site 8	MW8-10D	12/15/2015	< 200
Site 8	MW8-10D	3/22/2016	< 200
Site 8	MW8-10D	6/29/2016	< 25
Site 8	MW8-10D	9/29/2016	< 100
Site 8	MW8-10D	10/25/2016	< 50
Site 8	MW8-10D	10/30/2017	< 200
Site 8	MW8-10D	2/12/2018	< 200
Site 8	MW8-10D	4/26/2018	< 130
Site 8	MW8-10D	6/25/2018	< 130 J
Site 8	MW8-10D	10/17/2018	< 130
Site 8	MW8-10D	2/6/2019	< 130 J
Site 8	MW8-10D	4/17/2019	< 130 J
Site 8	MW8-10D	6/18/2019	< 130
Site 8	MW8-10D	10/21/2019	< 130 J
Site 8	MW8-11D	6/24/2015	< 25
Site 8	MW8-11D	6/29/2016	< 25
Site 8	MW8-11D	6/25/2018	< 130 J
Site 8	MW8-11D	6/18/2019	< 130
Site 8	MW8-8	9/1/2015	< 25
Site 8	MW8-8	12/15/2015	< 200
Site 8	MW8-8	3/22/2016	< 200
Site 8	MW8-8	6/29/2016	< 25
Site 8	MW8-8	9/29/2016	< 100
Site 8	MW8-8	10/30/2017	< 200
Site 8	MW8-8	10/30/2017	< 200
Site 8	MW8-8	2/12/2018	< 200
Site 8	MW8-8	4/26/2018	< 130
Site 8	MW8-8	6/25/2018	< 130 J
Site 8	MW8-8	10/17/2018	< 130
Site 8	MW8-8	2/6/2019	< 130
Site 8	MW8-8	4/17/2019	< 130 J
Site 8	MW8-8	6/18/2019	< 130
Site 8	MW8-8	10/21/2019	< 130 J
Site 10	MW10-10D	10/23/2014	< 25
Site 10	MW10-10D	10/23/2014	< 25
Site 10	MW10-10D	9/28/2015	< 500
Site 10	MW10-10D	10/27/2015	< 200
Site 10	MW10-10D	12/16/2015	< 200
Site 10	MW10-10D	3/23/2016	< 400
Site 10	MW10-10D	6/30/2016	< 25
Site 10	MW10-10D	9/29/2016	< 200
Site 10	MW10-10D	10/25/2016	< 50
Site 10	MW10-10D	10/25/2016	< 25
Site 10	MW10-10D	10/31/2017	< 2000
Site 10	MW10-10D	6/26/2018	< 1300 J
Site 10	MW10-10D	10/17/2018	< 310
Site 10	MW10-10D	2/6/2019	< 630 J
Site 10	MW10-10D	4/17/2019	< 130
Site 10	MW10-10D	7/8/2019	< 310

Table 1
Historical 1,4-Dioxane Concentrations in Groundwater
1,4-Dioxane Sampling Work Plan
Niagara Falls Air Reserve Station
Niagara Falls, New York

Site	Location ID	Date	1,4-Dioxane (µg/L)
Site 10	MW10-10D	10/21/2019	< 130 J
Site 10	MW10-1DA	10/23/2014	< 25
Site 10	MW10-1DA	9/28/2015	< 25
Site 10	MW10-1DA	10/27/2015	< 2000
Site 10	MW10-1DA	12/16/2015	< 200
Site 10	MW10-1DA	3/23/2016	< 1000
Site 10	MW10-1DA	6/30/2016	< 25
Site 10	MW10-1DA	9/29/2016	< 50
Site 10	MW10-1DA	10/25/2016	< 25
Site 10	MW10-1DA	10/31/2017	< 200
Site 10	MW10-1DA	6/26/2018	< 130
Site 10	MW10-1DA	10/17/2018	< 130
Site 10	MW10-1DA	2/6/2019	< 130
Site 10	MW10-1DA	4/17/2019	< 130
Site 10	MW10-1DA	7/8/2019	< 130
Site 10	MW10-1DA	10/21/2019	< 130
Site 10	MW10-2	12/16/2015	< 200
Site 10	MW10-2	3/23/2016	< 1000
Site 10	MW10-2	6/30/2016	< 25
Site 10	MW10-2	9/29/2016	< 500
Site 10	MW10-2	10/31/2017	< 200
Site 10	MW10-2	6/26/2018	< 130 J
Site 10	MW10-2	10/17/2018	< 130
Site 10	MW10-2	2/6/2019	< 130
Site 10	MW10-2	4/17/2019	< 130
Site 10	MW10-2	6/18/2019	< 130
Site 10	MW10-2	10/21/2019	< 130
Site 10	MW10-3	10/27/2015	< 200
Site 10	MW10-3	6/30/2016	< 25
Site 10	MW10-3	6/26/2018	< 130
Site 10	MW10-3	10/17/2018	< 130
Site 10	MW10-3	6/18/2019	< 130
Site 10	MW10-3D	10/23/2014	< 25
Site 10	MW10-3D	10/27/2015	< 200
Site 10	MW10-3D	10/25/2016	< 50
Site 10	MW10-3D	10/31/2017	< 200
Site 10	MW10-3D	10/17/2018	< 130
Site 10	MW10-3D	10/21/2019	< 130 J
Site 10	MW10-4D	10/23/2014	< 25
Site 10	MW10-4D	10/27/2015	< 200
Site 10	MW10-4D	10/25/2016	< 25
Site 10	MW10-4D	10/31/2017	< 200
Site 10	MW10-4D	10/17/2018	< 130
Site 10	MW10-4D	10/21/2019	< 130
Site 10	MW10-4E	10/23/2014	< 25
Site 10	MW10-4E	10/27/2015	< 200
Site 10	MW10-4E	10/25/2016	< 50
Site 10	MW10-4E	10/31/2017	< 200
Site 10	MW10-4E	10/21/2019	< 130
Site 10	MW10-7	6/24/2015	< 25
Site 10	MW10-7	6/30/2016	< 25
Site 10	MW10-7	6/26/2018	< 130
Site 10	MW10-7	10/17/2018	< 130
Site 10	MW10-7	6/18/2019	< 130
Site 10	MW10-9D	10/23/2014	< 25

Table 1
Historical 1,4-Dioxane Concentrations in Groundwater
1,4-Dioxane Sampling Work Plan
Niagara Falls Air Reserve Station
Niagara Falls, New York

SERES Engineering & Services, LLC
ARCADIS
a joint venture

Site	Location ID	Date	1,4-Dioxane (µg/L)
Site 10	MW10-9D	10/27/2015	< 200
Site 10	MW10-9D	10/25/2016	< 50
Site 10	MW10-9D	10/31/2017	< 200
Site 10	MW10-9D	10/17/2018	< 130
Site 10	MW10-9D	10/21/2019	< 130 J
Site 10	PW10-1	10/23/2014	< 25
Site 10	PW10-1	6/24/2015	< 25
Site 10	PW10-1	10/27/2015	< 400
Site 10	PW10-1	6/30/2016	< 25
Site 10	PW10-1	10/25/2016	< 25
Site 10	PW10-1	10/31/2017	< 200
Site 10	PW10-1	6/26/2018	< 130 J
Site 10	PW10-1	10/17/2018	< 130
Site 10	PW10-1	6/18/2019	< 130
Site 10	PW10-1	10/21/2019	< 130 J
Site 10	PW10-2	10/23/2014	< 25
Site 10	PW10-2	6/24/2015	< 25
Site 10	PW10-2	10/27/2015	< 200
Site 10	PW10-2	12/16/2015	< 200
Site 10	PW10-2	3/23/2016	< 200
Site 10	PW10-2	6/30/2016	< 25
Site 10	PW10-2	9/29/2016	< 100
Site 10	PW10-2	10/25/2016	< 25
Site 10	PW10-2	10/31/2017	< 200
Site 10	PW10-2	6/26/2018	< 130 J
Site 10	PW10-2	10/17/2018	< 130
Site 10	PW10-2	2/6/2019	< 130 J
Site 10	PW10-2	4/17/2019	< 130
Site 10	PW10-2	6/18/2019	< 130
Site 10	PW10-2	10/21/2019	< 310 J
Site 10	PZ10-7	6/24/2015	< 25
Site 10	PZ10-7	9/29/2015	< 25
Site 10	PZ10-7	10/27/2015	< 200
Site 10	PZ10-7	12/16/2015	< 200
Site 10	PZ10-7	3/23/2016	< 200
Site 10	PZ10-7	6/30/2016	< 25
Site 10	PZ10-7	9/29/2016	< 100
Site 10	PZ10-7	10/31/2017	< 200
Site 10	PZ10-7	6/26/2018	< 130 J
Site 10	PZ10-7	10/17/2018	< 130
Site 10	PZ10-7	2/6/2019	< 130 J
Site 10	PZ10-7	4/17/2019	< 130
Site 10	PZ10-7	6/18/2019	< 130
Site 10	PZ10-7	10/21/2019	< 130
Site 10	SW10-5	10/25/2016	< 25
Site 10	SW10-5	10/21/2019	< 130
Site 10	SW10-6	10/25/2016	< 50
Site 10	SW10-6	10/21/2019	< 130 J
Site 10	SW10-6	10/21/2019	< 130
Site 10	SW10-7	10/25/2016	< 50
Site 10	SW10-7	6/26/2018	< 130 J
Site 10	SW10-7	10/21/2019	< 130
Site 10	SW10-5	10/25/2016	< 50
Site 13	MW13-3	8/26/2015	< 25
Site 13	MW13-3	12/15/2015	< 200

Table 1
Historical 1,4-Dioxane Concentrations in Groundwater
1,4-Dioxane Sampling Work Plan
Niagara Falls Air Reserve Station
Niagara Falls, New York

SERES Engineering & Services, LLC
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Site	Location ID	Date	1,4-Dioxane (µg/L)
Site 13	MW13-3	3/22/2016	< 200
Site 13	MW13-3	6/29/2016	< 25
Site 13	MW13-3	9/29/2016	< 100
Site 13	MW13-3	10/30/2017	< 200
Site 13	MW13-3	6/25/2018	< 130
Site 13	MW13-3	10/17/2018	< 130
Site 13	MW13-3	2/6/2019	< 130
Site 13	MW13-3	4/17/2019	< 130
Site 13	MW13-3	10/21/2019	< 130 J
Site 13	MW13-3D	6/19/2019	< 130
Site 13	MW13-4	8/26/2015	< 25
Site 13	MW13-4	12/15/2015	< 200
Site 13	MW13-4	3/22/2016	< 200
Site 13	MW13-4	6/29/2016	< 25
Site 13	MW13-4	9/29/2016	< 100
Site 13	MW13-4	10/30/2017	< 200
Site 13	MW13-4	6/25/2018	< 130
Site 13	MW13-4	10/17/2018	< 130
Site 13	MW13-4	2/6/2019	< 130
Site 13	MW13-4	4/17/2019	< 130
Site 13	MW13-4	10/21/2019	< 130 J
Site 13	MW13-4D	10/23/2014	< 25
Site 13	MW13-4D	6/24/2015	< 25
Site 13	MW13-4D	10/27/2015	< 200
Site 13	MW13-4D	6/30/2016	< 25
Site 13	MW13-4D	10/25/2016	< 50
Site 13	MW13-4D	10/30/2017	< 200
Site 13	MW13-4D	6/25/2018	< 130
Site 13	MW13-4D	10/17/2018	< 130
Site 13	MW13-4D	6/19/2019	< 130
Site 13	MW13-4D	10/21/2019	< 130 J
Site 13	MW13-5A	8/25/2015	< 25
Site 13	MW13-5A	12/15/2015	< 200
Site 13	MW13-5A	3/22/2016	< 200
Site 13	MW13-5A	6/29/2016	< 25
Site 13	MW13-5A	9/29/2016	< 100
Site 13	MW13-5A	10/30/2017	< 200
Site 13	MW13-5A	6/25/2018	< 130
Site 13	MW13-5A	10/17/2018	< 130
Site 13	MW13-5A	2/6/2019	< 130
Site 13	MW13-5A	4/17/2019	< 130
Site 13	MW13-5A	6/19/2019	< 130
Site 13	MW13-5A	10/21/2019	< 130 J
Site 13	MW13-5D	10/23/2014	< 25
Site 13	MW13-5D	6/24/2015	< 25
Site 13	MW13-5D	8/26/2015	< 25
Site 13	MW13-5D	10/27/2015	< 200
Site 13	MW13-5D	12/15/2015	< 200
Site 13	MW13-5D	3/22/2016	< 200
Site 13	MW13-5D	6/29/2016	< 25
Site 13	MW13-5D	9/29/2016	< 100
Site 13	MW13-5D	10/25/2016	< 50
Site 13	MW13-5D	10/30/2017	< 200
Site 13	MW13-5D	6/25/2018	< 130
Site 13	MW13-5D	10/17/2018	< 130

Table 1
Historical 1,4-Dioxane Concentrations in Groundwater
1,4-Dioxane Sampling Work Plan
Niagara Falls Air Reserve Station
Niagara Falls, New York

SERES Engineering & Services, LLC
ARCADIS
a joint venture

Site	Location ID	Date	1,4-Dioxane (µg/L)
Site 13	MW13-5D	2/6/2019	< 130
Site 13	MW13-5D	4/17/2019	< 130
Site 13	MW13-5D	6/19/2019	< 130
Site 13	MW13-5D	10/21/2019	< 130 J
Site 13	PW13-1	8/26/2015	< 25
Site 13	PW13-1	10/27/2015	< 200
Site 13	PW13-1	12/15/2015	< 200
Site 13	PW13-1	3/22/2016	< 200
Site 13	PW13-1	6/29/2016	< 25
Site 13	PW13-1	9/29/2016	< 100
Site 13	PW13-1	10/25/2016	< 50
Site 13	PW13-1	10/30/2017	< 200
Site 13	PW13-1	6/25/2018	< 130
Site 13	PW13-1	10/17/2018	< 130
Site 13	PW13-1	2/6/2019	< 130
Site 13	PW13-1	4/17/2019	< 130
Site 13	PW13-1	6/19/2019	< 130
Site 13	PW13-1	10/21/2019	< 130 J
Site 13	PW13-4D	8/26/2015	< 25
Site 13	PW13-4D	8/26/2015	< 25
Site 13	PW13-4D	10/27/2015	< 200
Site 13	PW13-4D	6/30/2016	< 25
Site 13	PW13-4D	10/25/2016	< 50
Site 13	PW13-4D	6/25/2018	< 130
Site 13	PW13-4D	10/17/2018	< 130
Site 13	PW13-4D	6/19/2019	< 130
Site 13	PW13-4D	10/21/2019	< 130 J
Site 13	PZ13-4D	10/30/2017	< 200
Site 13	PZ13-3D	8/26/2015	< 25
Site 13	PZ13-3D	8/26/2015	< 25
Site 13	PZ13-3D	12/15/2015	< 200
Site 13	PZ13-3D	3/22/2016	< 200
Site 13	PZ13-3D	6/29/2016	< 25
Site 13	PZ13-3D	9/29/2016	< 100
Site 13	PZ13-3D	10/30/2017	< 200
Site 13	PZ13-3D	6/25/2018	< 130
Site 13	PZ13-3D	10/17/2018	< 130
Site 13	PZ13-3D	2/6/2019	< 130
Site 13	PZ13-3D	6/19/2019	< 130
Site 13	PZ13-3D	10/21/2019	< 130 J

Notes:
1. Maximum concentrations are in units of micrograms per liter (µg/L).
2. Historical 1,4-dioxane samples analyzed by USEPA Method 8260C.
3. **Bold** indicates a detected value.

Abbreviation:
< = concentration was less than the detection limit

Qualifiers:
J = Estimated value,. The result is greater than or equal to the method detection limit and less than the limit
R = Rejected value

Table 2
Maximum Concentrations of 1,4-Dioxane Indicator Compounds
1,4-Dioxane Sampling Work Plan
Niagara Falls Air Reserve Station
Niagara Falls, New York

SERES Engineering & Services, LLC
ARCADIS
a joint venture

Site ID	1,4-Dioxane			1,1,1-TCA			1,1-DCA			1,1-DCE			TCE		
	Maximum Concentration	Location	Sample Date	Maximum Concentration	Location	Sample Date	Maximum Concentration	Location	Sample Date	Maximum Concentration	Location	Sample Date	Maximum Concentration	Location	Sample Date
LF008 (Site 3)	61.4 J	MW3-3DA	6/26/2018	0.62	PW3-3A	7/8/1993	ND	--	--	6	PW3-1	9/23/1997	1200	PW3-1	11/13/1996
DS004 (Site 5)	129 J	RW5-1	6/25/2018	23.9	RW5-4	5/31/2001	1.1	MW5-8D	9/15/1998	190	MW5-5D	5/24/2005	113,000	MW5-5D	6/1/2001
DS002 (Site 8)	ND	--	--	3.2	MW8-1	12/6/1993	2.04	MW8-3DA	10/24/2003	5.91	MW8-1	9/14/1999	610	MW8-1	9/20/1995
FT005 (Site 10)	ND	--	--	1.97	MW10-9D	12/10/1991	0.48	PW10-1	11/26/2007	170	MW10-10D	3/23/1999	79,700	MW10-10D	9/16/1999
ST010 (Site 13)	ND	--	--	25	MW13-5D	3/24/1995	25	MW13-5D	3/24/1995	25	MW13-5D	3/24/1995	103	PW13-1	2/27/2002

Note:
1. Maximum concentrations are in units of micrograms per liter.

Acronyms and Abbreviations:
1,1-DCA = 1,1-dichloroethane
1,1-DCE = 1,1-dichloroethene
1,1,1-TCA = 1,1,1-trichloroethane
-- = not applicable
ND = nondetect
TCE = trichloroethene

Qualifier:
J = Estimated value. The result is greater than or equal to the method detection limit and less than the limit of quantitation.

Table 3
Justification for Selection of Wells and Deviations from Guidance Memorandum
1,4-Dioxane Sampling Work Plan
Niagara Falls Air Reserve Station
Niagara Falls, New York

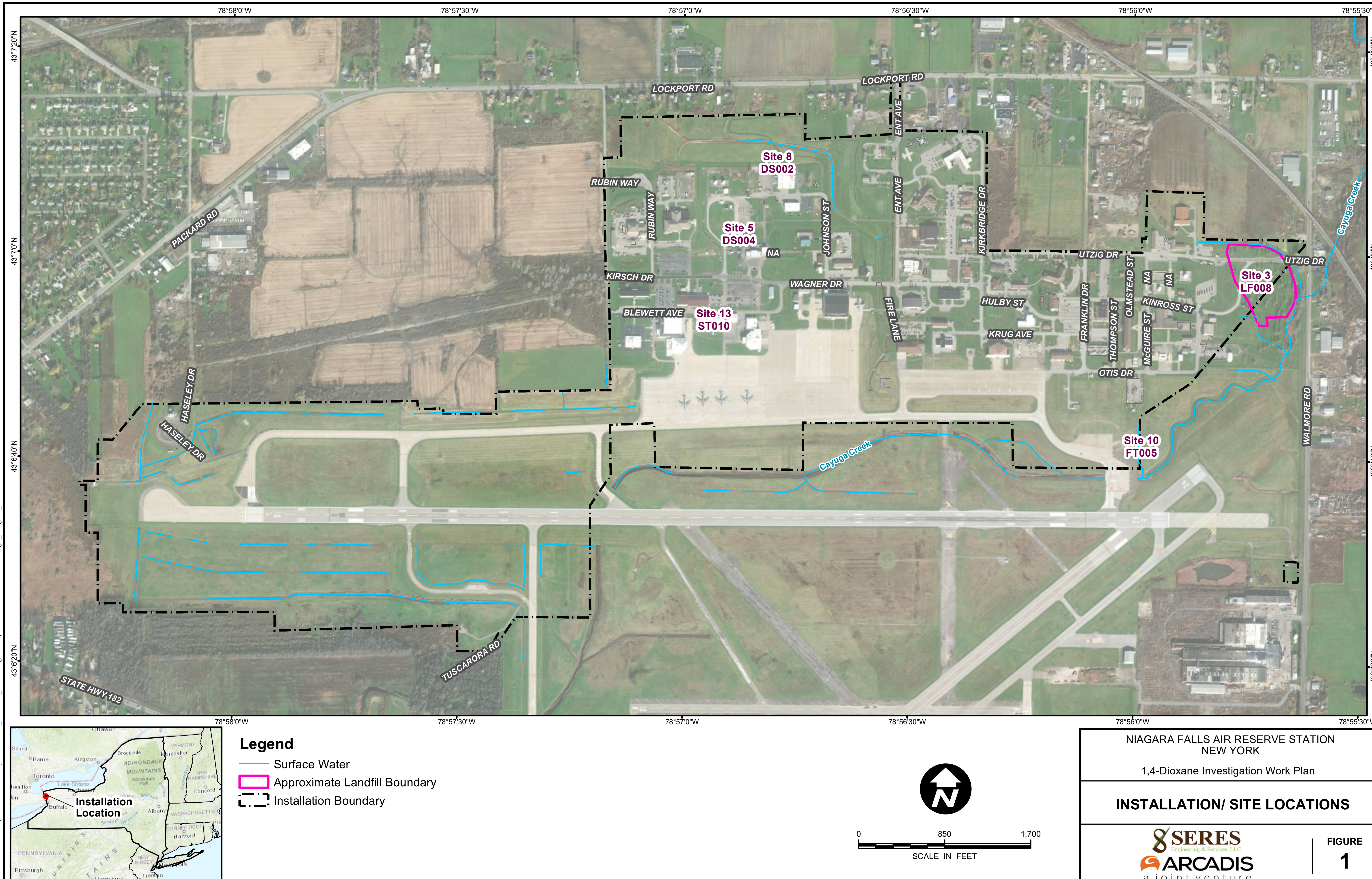
SERES Engineering & Services, LLC
ARCADIS
a joint venture

Site ID	Well ID	Well Depth	Justification for Inclusion	Notes
LF008 (Site 3)	MW3-3DA	Shallow Bedrock	Historical detections of cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride (VC) at concentrations above the Groundwater Protection Standards (GPS) in bedrock well located east of Cayuga Creek.	Identification of downgradient and distal wells between source area and Cayuga Creek is not possible due to proximity of creek to former landfill; therefore, MW3-5D, PW3-3A, and PZ3-1D are proposed for sampling. In addition, MW3-3DA and PZ3-7D are proposed to investigate potential impacts east of Cayuga Creek.
	MW3-5D	Shallow Bedrock	Selected based on proximity to PW3-1 which was previously decommissioned, but had historically high concentrations of indicator compounds.	
	PW3-3A	Shallow Bedrock	Historically high concentrations of indicator compounds; southwest extent of source area; near surface water discharge.	
	PZ3-1D	Shallow Bedrock	Historically high concentrations of indicator compounds; in center of source area plume.	
	PZ3-7D	Shallow Bedrock	Historical detections of cis-1,2-DCE and VC at concentrations above the GPS in bedrock piezometer located east of Cayuga Creek.	
DS004 (Site 5)	MW5-1DA	Shallow Bedrock	Downgradient well	Although MW5-1DA and MW5-4 may hydraulically side-gradient, a review of historic data and contour maps indicating divergent overburden groundwater flow support the selection of these wells to investigate potential impacts in northwest portion of Site.
	MW5-4	Overburden	Downgradient well	
	MW5-4D	Shallow Bedrock	Downgradient well	
	MW5-5D	Shallow Bedrock	Source area well	
	RW5-1	Overburden	Source area well	
	RW5-4	Overburden	Downgradient well	
DS002 (Site 8)	MW8-1	Overburden	Source area well	MW8-8 may be hydraulically sidegradient of MW8-1; however, historic data supports selection of this well.
	MW8-8	Overburden	Source area well	
	MW8-4D	Shallow Bedrock	Downgradient/Distal well	

Table 3
Justification for Selection of Wells and Deviations from Guidance Memorandum
1,4-Dioxane Sampling Work Plan
Niagara Falls Air Reserve Station
Niagara Falls, New York

Site ID	Well ID	Well Depth	Justification for Inclusion	Notes
FT005 (Site 10)	MW10-4D	Shallow Bedrock	Downgradient well	A review of historic groundwater contour maps indicating divergent groundwater flow supports the selection of MW10-4D, MW10-9D, and MW10-11D as downgradient wells. MW10-7 proposed to investigate potential overburden impacts. MW10-4E proposed to investigate potential deep bedrock impacts.
	MW10-4E	Deep Bedrock	Downgradient well	
	MW10-7	Overburden	Downgradient well	
	MW10-9D	Shallow Bedrock	Downgradient well	
	MW10-10D	Shallow Bedrock	Source area well	
	MW10-11D	Shallow Bedrock	Downgradient well	
ST010 (Site 13)	MW13-3	Overburden	No overburden wells currently sampled under IWGP; well selected based on proximity to source area.	A review of historic groundwater contour maps indicating divergent groundwater flow supports the selection of MW13-6D and PZ13-4D as downgradient wells. MW13-3 proposed to investigate potential overburden impacts. MW13-4D proposed to investigate potential impacts in southwest portion of Site.
	MW13-4D	Shallow Bedrock	Historical detections of cis-1,2-DCE and VC at concentrations above the GPS in southwest portion of the Site.	
	MW13-6D	Shallow Bedrock	Downgradient well	
	PW13-1	Shallow Bedrock	Source area well	
	PZ13-3D	Shallow Bedrock	Downgradient well	

Figures



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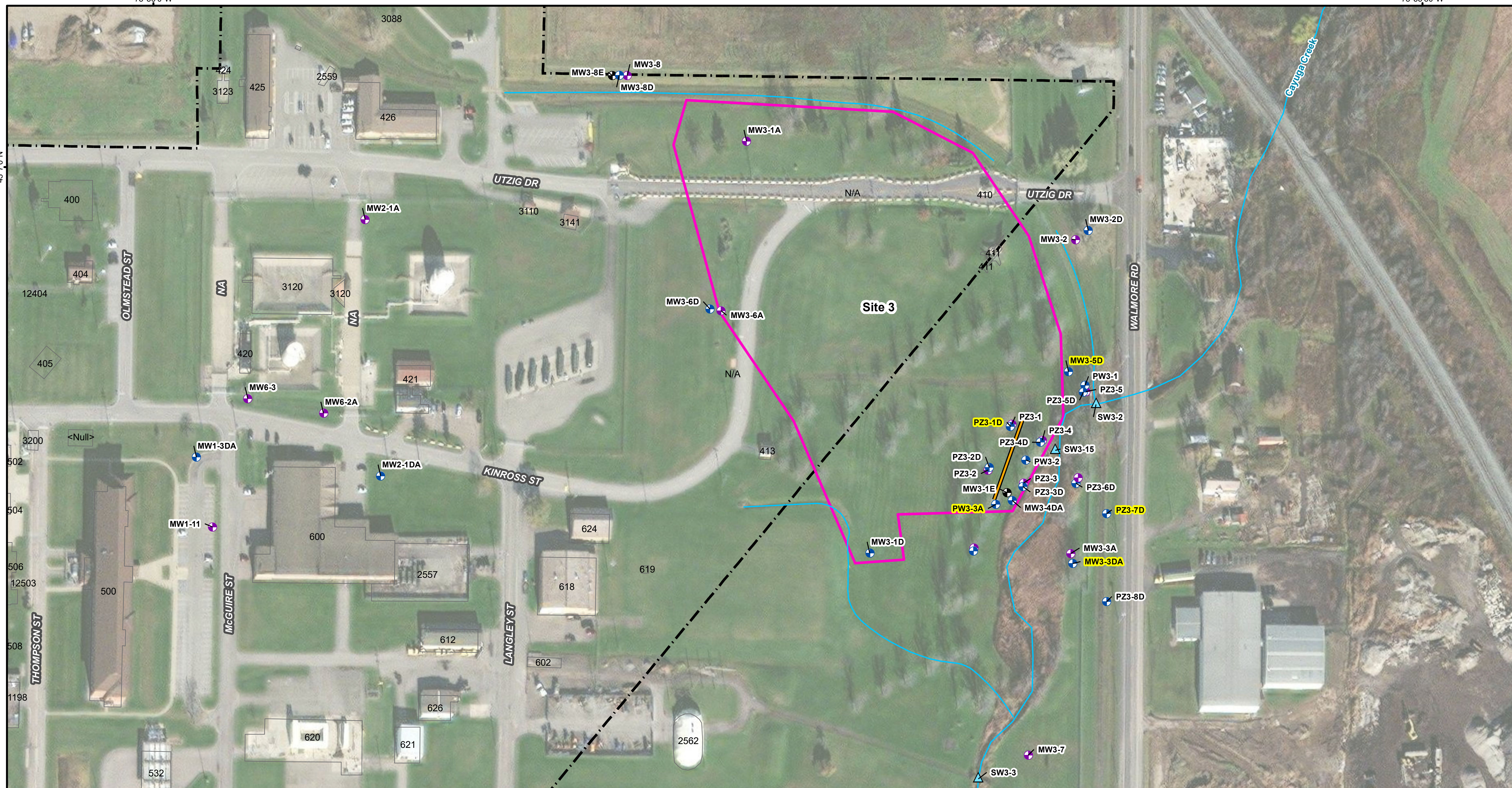

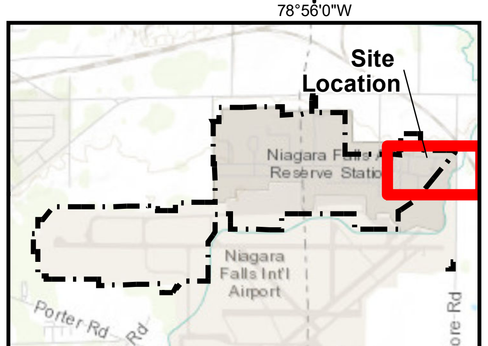

Legend

- Deep Bedrock Well
- Overburden Well/Piezometer
- Shallow Bedrock Well/Piezometer
- Surface Water Sample Location
- PW3-1 Proposed 1,4-Dioxane Sampling Location
- Surface Water
- Groundwater Collection Trench
- Approximate Landfill Boundary
- Installation Boundary

0 170 340

SCALE IN FEET

NIAGARA FALLS AIR RESERVE STATION
NEW YORK

1,4-Dioxane Investigation Work Plan

LF008 (SITE 3) - SITE PLAN AND PROPOSED SAMPLING LOCATIONS

SERES Engineering & Services, LLC
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FIGURE
2

DIV/GROUP: ENV/IMDV DB: sbi01179 LD: PIC: PM: TM:
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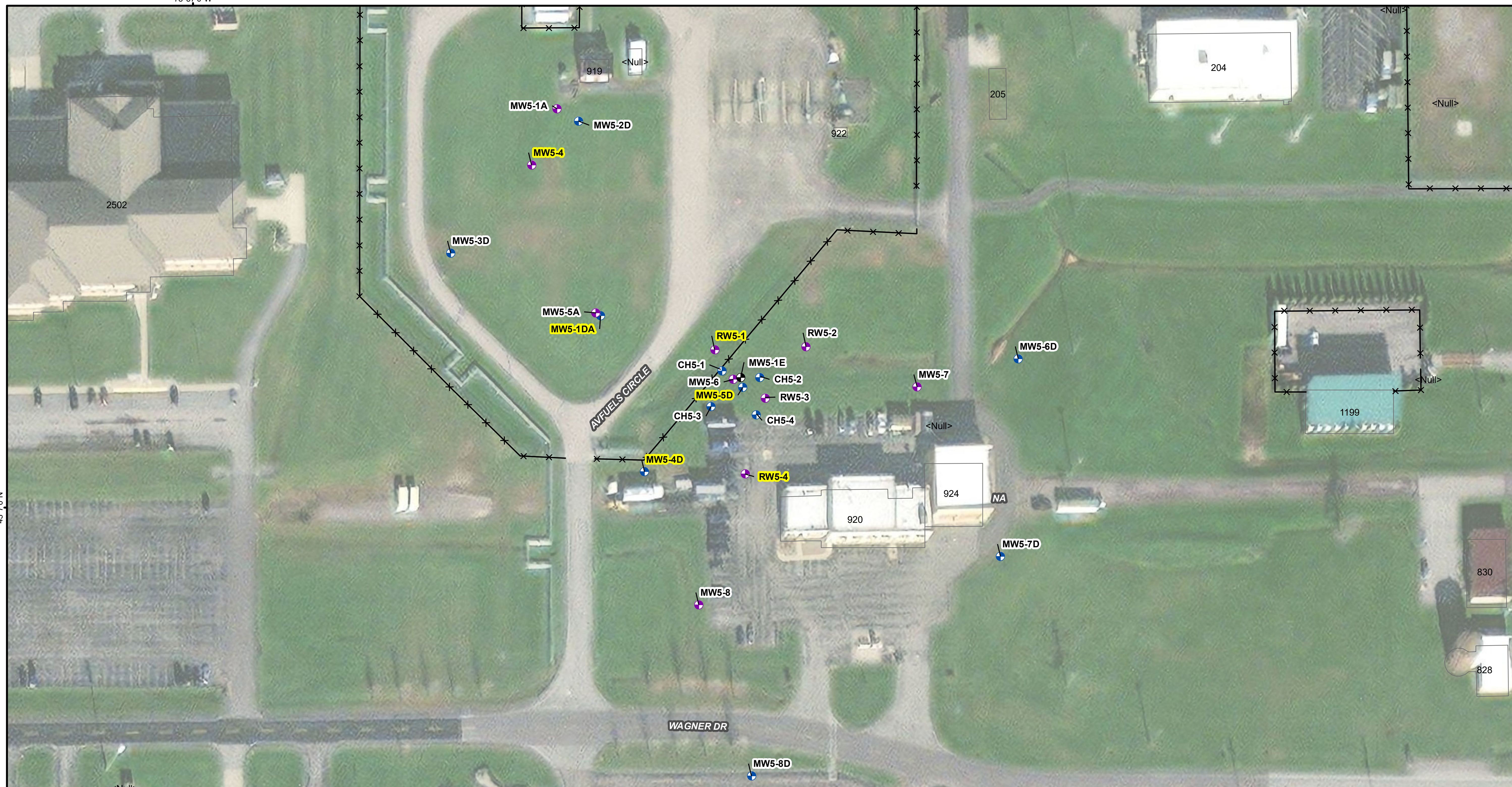

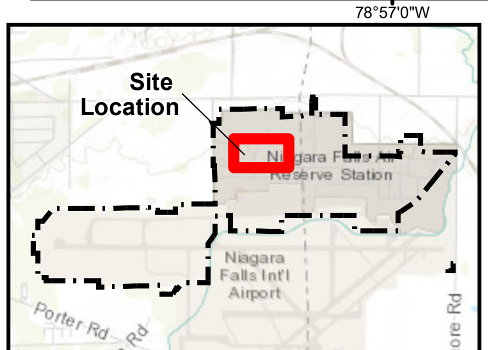

Legend

- Deep Bedrock Well
- Overburden Well/Piezometer
- Shallow Bedrock Well/Piezometer
- RW5-4 Proposed 1,4-Dioxane Sampling Location
- Fence
- Installation Boundary

0 100 200
SCALE IN FEET

NIAGARA FALLS AIR RESERVE STATION
NEW YORK

1,4-Dioxane Investigation Work Plan

DS004 (SITE 5) - SITE PLAN AND PROPOSED SAMPLING LOCATIONS

SERES Engineering & Services, LLC
ARCADIS
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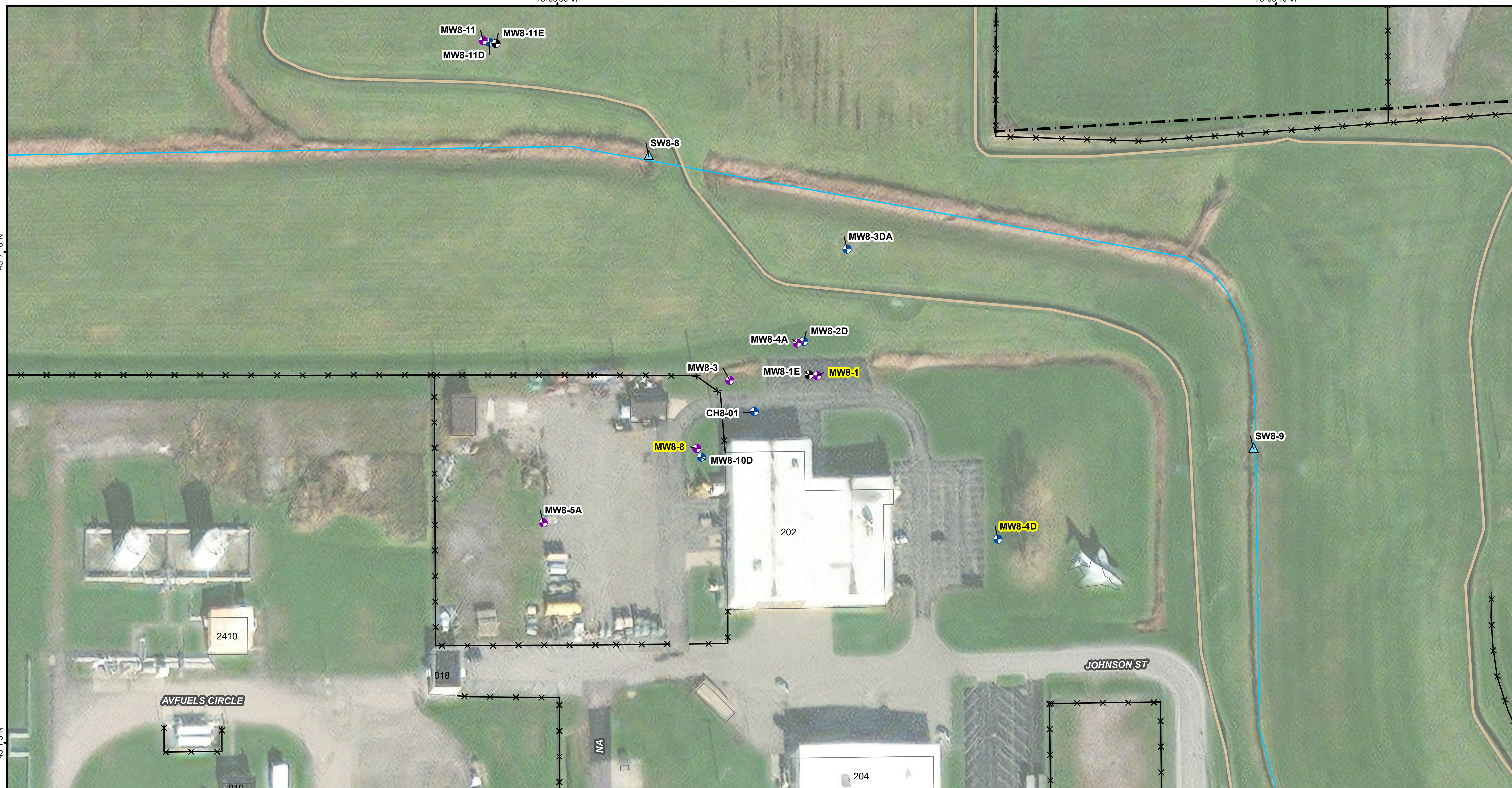
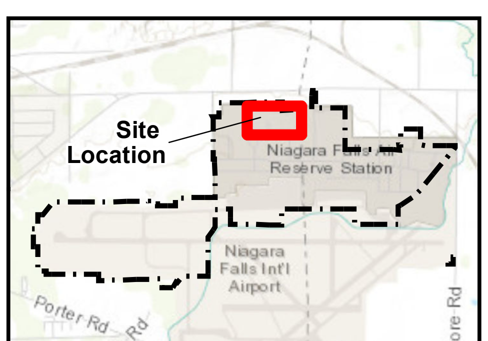
FIGURE
3

DIV/GROUP: ENV/IMDV DB: sbi01179 LD: PIC: PM: TM:
PROJECT: JBMDL (30028498.00001) PATH: T:_ENV\NE_ORC\Niagara\Reports\Dioxane IWP\MXDs\Fig3_Niagara_Site5.mxd DATE: 4/21/2022 12:29:32 PM





Legend

- Deep Bedrock Well
- Overburden Well/Piezometer
- Shallow Bedrock Well/Piezometer
- Surface Water Sample Location
- MW8-8 Proposed 1,4-Dioxane Sampling Location
- Surface Water
- Recreation Trail
- Fence
- Installation Boundary

0 100 200
SCALE IN FEET

NIAGARA FALLS AIR RESERVE STATION
NEW YORK

1,4-Dioxane Investigation Work Plan

DS002 (SITE 8) - SITE PLAN AND PROPOSED SAMPLING LOCATIONS

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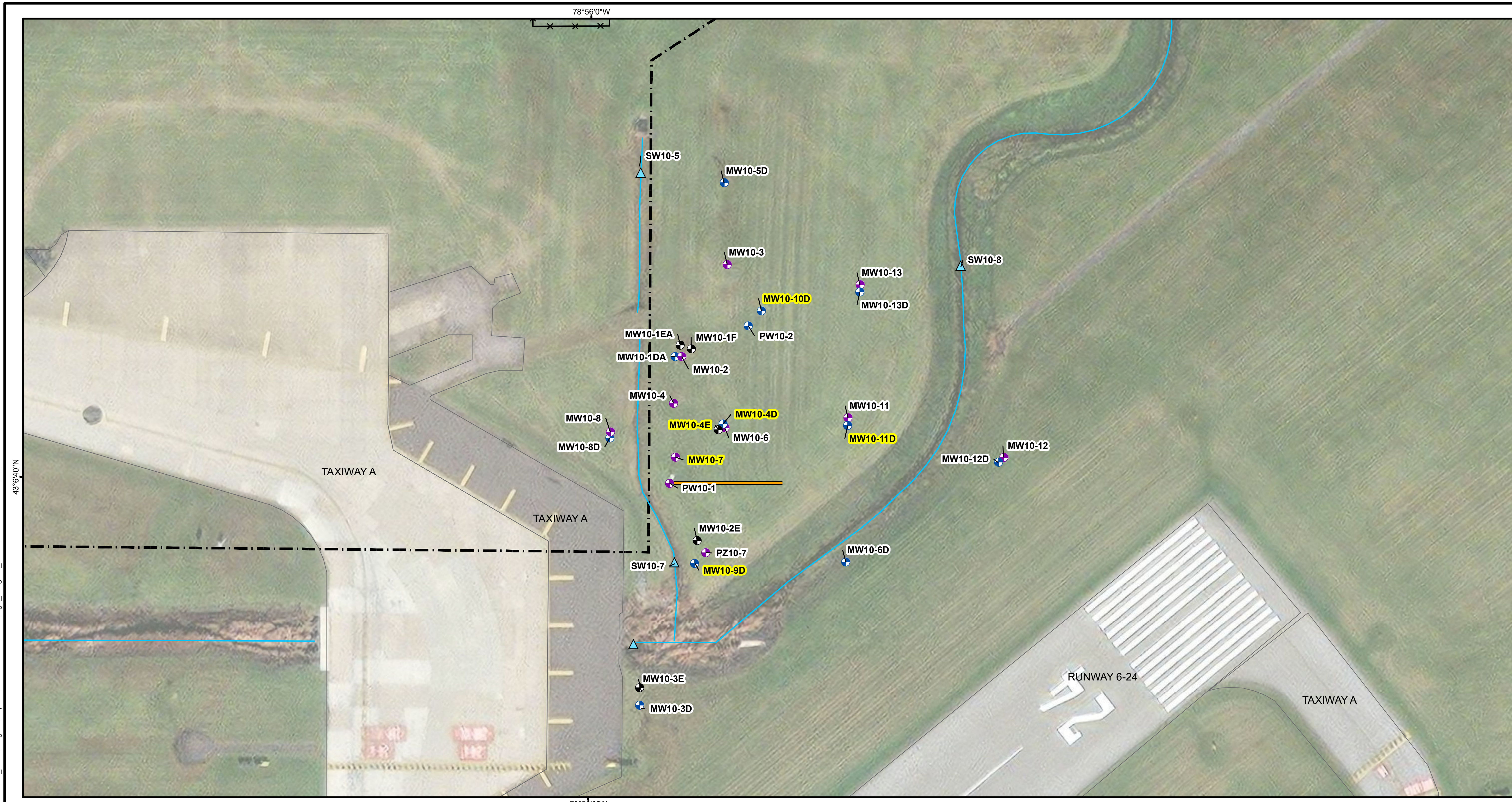
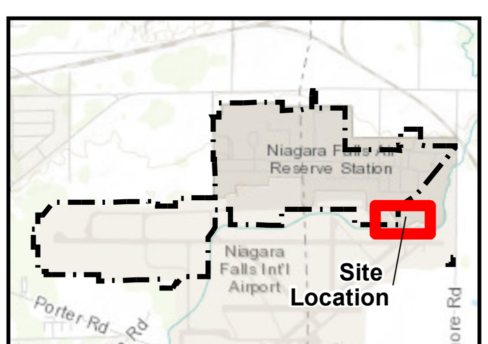
FIGURE
4

DIV/GROUP: ENV/IMDV DB: sbi01179 LD: PIC: PM: TM:
PROJECT: JBMDL (30028498.00001) PATH: T:_ENV\NE_ORC\Niagara\Reports\Dioxane IWP\MXDs\Fig4_Niagara_Site8.mxd DATE: 10/15/2021 10:22:11 AM





Legend

- Deep Bedrock Well
- Overburden Well/Piezometer
- Shallow Bedrock Well/Piezometer
- Surface Water Sample Location
- MW10-9D Proposed 1,4-Dioxane Sampling Location
- Surface Water
- Groundwater Collection Trench
- Installation Boundary

0 100 200
SCALE IN FEET

NIAGARA FALLS AIR RESERVE STATION
NEW YORK

1,4-Dioxane Investigation Work Plan

FT005 (SITE 10) - SITE PLAN AND PROPOSED SAMPLING LOCATIONS

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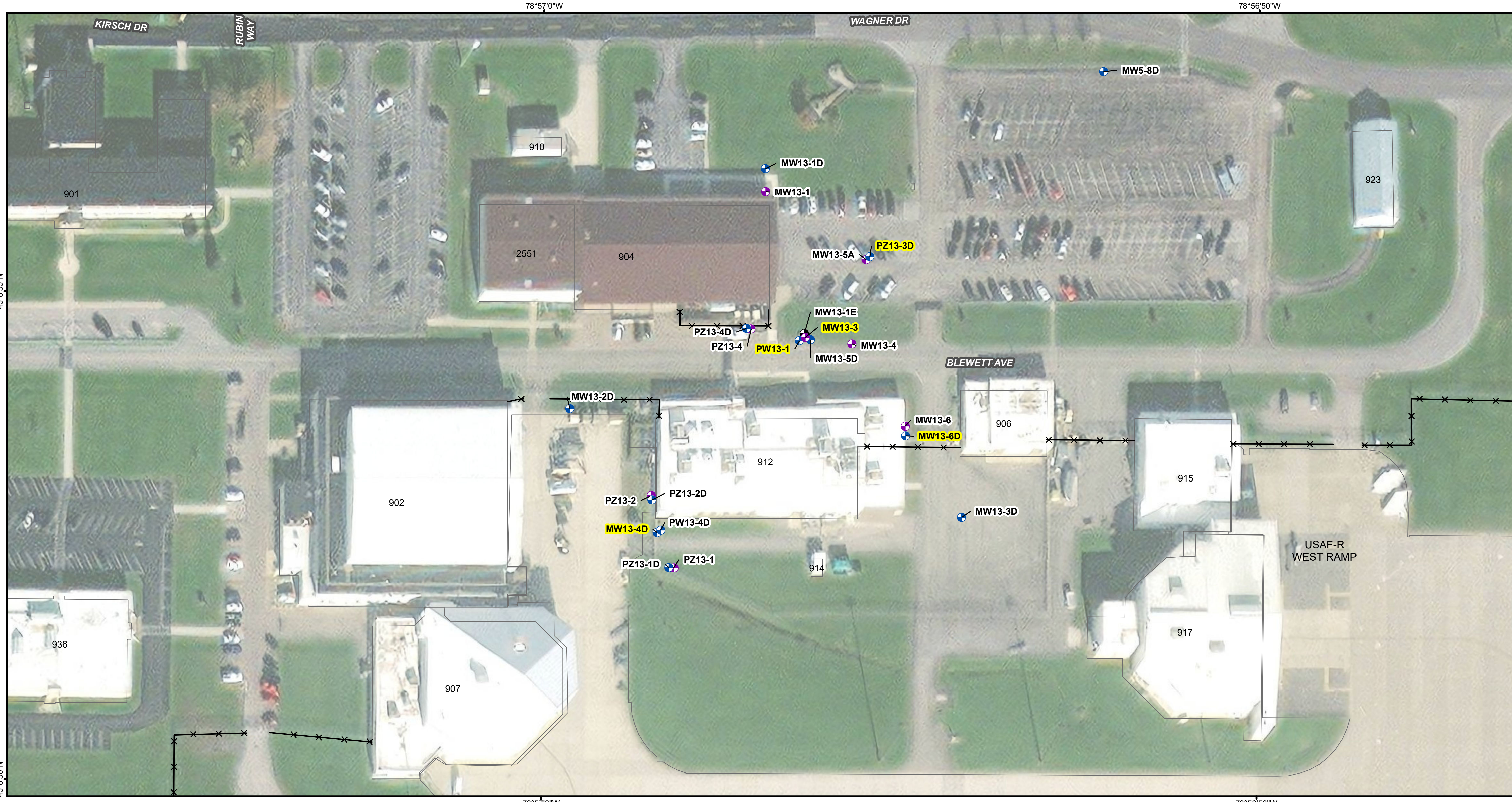
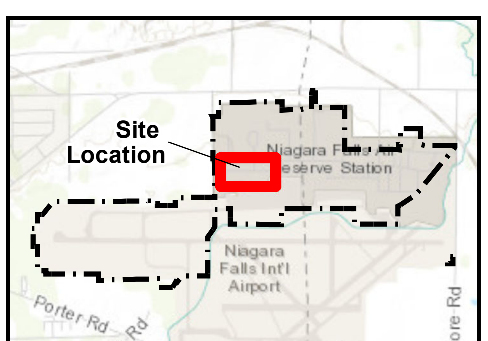
FIGURE
5

DIV/GROUP: ENV/IMDV DB: sbi01179 LD: PIC: PM: TM:
PROJECT: JBMDL (30028498.00001) PATH: T:_ENV\NE_ORC\Niagara\Reports\Dioxane IWP\MXDs\Fig5_Niagara_Site10.mxd DATE: 10/15/2021 12:20:21 PM





Legend

- Deep Bedrock Well
- Overburden Well/Piezometer
- Shallow Bedrock Well/Piezometer
- PW13-1 Proposed 1,4-Dioxane Sampling Location
- Fence
- Installation Boundary

NIAGARA FALLS AIR RESERVE STATION
NEW YORK

1,4-Dioxane Investigation Work Plan

ST010 (SITE 13) - SITE PLAN AND PROPOSED SAMPLING LOCATIONS

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FIGURE
6

DIV/GROUP: ENV/IMDV DB: sbell LD: PIC: PM: TM:
PROJECT: JBMDL (30028498.00001) PATH: T:_ENV\NE_ORC\Niagara\Reports\Dioxane IWP\MXDs\Fig6_Niagara_Site13.mxd DATE: 4/28/2022 1:43:12 PM

Attachment A

Interim Air Force Guidance on Sampling and Response Actions for 1,4-Dioxane at Operational and Base Realignment and Closure Installations

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, DC

15 AUG 2013

MEMORANDUM FOR SEE DISTRIBUTION LIST

FROM: HQ USAF/A7C
1260 Air Force Pentagon
Washington, DC 20330-1260

SUBJECT: Guidance on 1,4 Dioxane, Environmental Restoration Program

This memorandum serves as Air Staff guidance for responding in a standardized way to 1,4 Dioxane, a solvent stabilizer. Some regulatory agencies have expressed concerns regarding 1,4 Dioxane during the cleanup process. Due to evolving science and regulatory standards, 1,4 Dioxane presents a potentially unacceptable human health or environmental risk. As a result, the Air Force will respond to 1,4 Dioxane subject to DoDI 4715.18, *Emerging Contaminants*. The following actions apply:

a. AFCEC and the NGB should implement the DoDI and the attached guidance at active installations, BRAC installations, transferring properties, GOCO properties, NGB properties, other than operational ranges and active ranges (for the non-munitions constituents) accordingly by providing technical guidance to the MAJCOMs and installations as necessary.

b. AFCEC and the NGB should program and budget for appropriate response actions when warranted.

MAJCOMs and installations should refer requests for sampling and other response actions to Mr. William Ryan, AFCEC/CZR, DSN 969-8783, william.ryan.1@us.af.mil. NGB installations should contact Mr. Russ Dyer, NGB/A7OR, DSN 612-8149, russell.dyer@ang.af.mil. and BRAC installations should contact Dr. Steve Termaath, AFCEC/CIB, DSN 969-9428, stephen.termaath@us.af.mil. Any further questions on Emerging Contaminants should be addressed to Ms. Elaine Ross, A7CEV, DSN 612-4260, elaine.ross@pentagon.af.mil.

MARK A. CORRELL, SES, P.E.
The Deputy Civil Engineer
DCS/Logistics, Installations & Mission Support

Attachment:
Interim AF Guidance On Sampling and Response Actions for 1,4-Dioxane at Operational and BRAC Installations

cc:
HQ ACC/A7
HQ AETC/A4/7
HQ AFMC/A6/7
HQ AFRC/A7
HQ AFSOC/A7
HQ AFSPC/A4/7
HQ AMC/A7
HQ AFGSC/A4/7
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Interim
Air Force Guidance
On Sampling and Response Actions for
1,4-Dioxane at Operational and BRAC Installations

Summary. Consistent with DoDI 4715.18, *Emerging Contaminants*, 1,4-dioxane is considered to be an Air Force emerging contaminant based on changing health screening levels. 1, 4-Dioxane is a "listed" Comprehensive Environmental Response Compensation and Liabilities Act (CERCLA) "hazardous substance" and, thus, the Air Force has an obligation to address environmental releases of 1,4-dioxane above unacceptable risk levels. However, there is currently no federally promulgated regulatory cleanup level.

EPA is currently collecting drinking water occurrence and exposure data to determine if establishment of a maximum contaminant level (MCL) is warranted under the Safe Drinking Water Act based on the occurrence of 1,4-dioxane in drinking water, the number of people potentially being exposed, and observed exposure levels. EPA's 2010 Integrated Risk Information System toxicity assessment has been extrapolated by three EPA Regions[1] to yield a residential tap water screening level of 0.67 µg/L and a soil screening level of 4.9 mg/kg. Additionally, several state governments have implemented screening levels and/or standards for characterizing and remediating 1,4-dioxane, particularly for groundwater contamination; however, few states have promulgated standards or applicable or relevant and appropriate requirements (ARARs).

1. Purpose. The Air Force has developed this guidance to promote consistent response actions applicable to both operational and Base Realignment and Closure (BRAC) installations and to facilitate identification of funding requirements for needed actions for AFCEC Restoration Program Management Office programming purposes. This guidance accomplishes the following:

A. Establishes an Air Force enterprise-wide strategy for sampling and response actions for 1,4-dioxane at applicable Environmental Restoration Program (ERP) sites

B. Provides supporting technical information for analysis and risk assessment.

It will be updated on a periodic basis to reflect applicable regulatory changes.

2. Applicability. This guidance excludes ERP sites in response complete (RC), long-term monitoring (LTM), or site closeout (SC) phases per DoDM 4715.20 (*Defense Environmental Restoration Program Management)* and ERP sites on transferred property for which the Air Force no longer has primary responsibility for restoration activities. Also excluded are sites that have ongoing response actions addressing 1,4 dioxane or those that have already tested for 1,4 dioxane using analytical methods with appropriate detection limits (see attachment 1). Specifically included in this guidance are ERP sites

[1] Available: http://www.epa.gov/region9/superfund//prg/index.html

in remedial action operation (RA-O) or earlier phases with any historic validated detection of 1,1,1-trichloroethane (TCA); the TCA degradation products 1,1-dichloroethane (DCA) or 1,1-dichloroethene (DCE); or trichloroethylene (TCE) in groundwater. These sites constitute "applicable sites" for the purpose of this guidance.

3. Process. At ERP sites currently conducting response actions to address 1,4-dioxane, investigations and/or remedial actions will continue according to legal requirements as determined through the applicable cleanup framework (normally CERCLA or RCRA). At remaining "applicable sites," the Air Force should apply the following three steps to evaluate 1,4-dioxane under this guidance:

Step 1. Determine if a release of 1,4-dioxane has occurred;

Step 2. Characterize the extent of release if 1,4-dioxane is present; and

Step 3. Determine if potential response action is warranted based on an unacceptable risk to human health.

Air Force personnel should re-evaluate the characterization and protectiveness of response actions, if any, regarding 1,4-dioxane at applicable sites during five-year reviews. Air Force personnel should also re-evaluate whether there have been promulgated regulations or ARARs in the intervening period and determine if compliance with the new standard would be deemed necessary to achieve protectiveness.

A. **New Regulatory Requests for Sampling.**

i. Upon receiving a new request to sample for 1,4-dioxane, the installation must notify AFCEC/CZR (operational installations) or AFCEC/CIB (BRAC installations) prior to any 1,4-dioxane-related sampling action.

ii. A request for sampling must be in writing (letter or e-mail) from a regulatory agency having jurisdiction over restoration activities or the potentially affected resource, and it must cite the local, state, or federal statute, regulation, or written agreement justifying the request.

iii. The Restoration Program Manager (RPM) or Base Environmental Coordinator (BEC) will coordinate and obtain authorization from the AFCEC/CZR (operational installations), or AFCEC/CIB (BRAC installations). AFCEC/CZR or AFCEC/CIB will validate the legal basis for any requested sampling with AFLOA/JACE-FSC, verify reasonably suspected basis to suspect release, and coordinate technical issues with AFCEC/CZTE before authorizing sampling.

iv. If the request for testing involves an Air Force drinking water supply, the RPM will coordinate with the base BE in addition to AFCEC/CZR.

v. Initial sampling (Step One), when authorized, should be a one-time event to determine if 1,4-dioxane is present in the environment as a result of Air Force-related activities. The quality assurance project plan (QAPP) for the field efforts should comply with the technical guidance in Attachment 1.

B. **Air Force ERP Enterprise-Wide Response to 1,4-Dioxane .** The Air Force will address potential release of 1,4-dioxane at applicable sites as defined above in Section 2.

i. **Step One**. Confirm release of 1,4-dioxane only at sites meeting the applicability criteria above.

1) Air Force RPMs or BECs in the United States, at "applicable sites" must prepare a schedule and Project Cost Estimating Assumptions Document (PCEAD) to program funds for Step One, 1,4-dioxane release confirmation, following AFCEC/CZR guidance. AFCEC/CZR (operational installations) or AFCEC/CIB (BRAC installations) will coordinate and validate the program funding requests and coordinate technical issues with AFCECE/CZTE before authorizing sampling.

2) At "applicable sites" with groundwater contamination impacting drinking water supply wells, Air Force RPMs or BECs in the United States should program funds for release confirmation at the earliest achievable date and, if warranted, continue with Step Two (additional characterization) and Step Three (potential response action) and shall consider whether time-critical removal action (or the RCRA equivalent) is warranted.

3) Confirmation sampling will include collection and analysis of approximately three existing groundwater monitoring wells (GMW) along the axis of the applicable chlorinated solvent plume at each site: one sample from an existing GMW, located as close as possible to known source contamination; one additional sample from an existing GMW at the down gradient limit of plume migration; and another sample from an existing GMW beyond the plume limit. Sample locations will be selected along the axis of primary groundwater flow direction. It is assumed that results of prior investigation(s) will inform work planning. Sampling activities will be programmed and executed according to the current site status.

4) Data collected from sampling should be of sufficient quality and quantity to definitively assess occurrence of 1,4-dioxane. Data collection must comply with the Uniform Federal Policy UFP-QAPP; data must meet minimum requirements defined in the DoD Quality Systems Manual, current version; and laboratories used for analysis must be accredited by the DoD Environmental Laboratory Accreditation Program (ELAP). It is anticipated that existing work plans at active sites can be adapted to incorporate sampling

and analysis for 1,4-dioxane. Please refer to Attachment 1 "Technical Support Information: Section 4" for information on analytical methods and data quality references.

5) Confirmation of release will be based on measured concentrations in groundwater above the EPA residential tap water screening level of 0.67 µg/L.

6) Once detection over the screening level has been confirmed, the RPM and applicable Air Force offices shall coordinate with regulatory agencies as required and appropriate under the applicable cleanup framework (normally CERCLA or RCRA). At operational installations, notify the installation BE that additional sampling is warranted. If no installation BE exists, then notify USAFSAM/OE.

ii. **Step Two.** If 1,4-dioxane is present, characterize the extent of release.

1) For purposes of this guidance "characterization" is defined as determining the length, depth, and width of contaminant impact(s) to soil and groundwater. The extent of release will be defined by the EPA residential tap water screening level of 0.67 µg/L in groundwater and a soil screening level of 4.9 mg/kg. Results of characterization will support evaluation of potential risk of human exposure to 1,4-dioxane consistent with an appropriate conceptual site model. It is assumed that site-specific information and prior investigation(s) will inform work planning. See "Technical Support Information: Section 5" for information on risk evaluation and pathway assessment.

2) The RPM or BEC will prepare follow-on PCEADs to characterize the nature and extent of 1,4-dioxane release and to evaluate risk to human health. AFCEC/CZR (operational installations) or AFCEC/CIB (BRAC installations) will validate Step Two funding requests and coordinate technical issues with AFCEC/CZTE.

3) When Step Two results indicate potential human exposure at operational installations, the RPM will coordinate with the installation BE flight if there is potential contamination of an Air Force drinking water supply. At BRAC installations, the BEC shall coordinate with regulatory agencies as required and appropriate under the applicable cleanup framework (normally CERCLA or RCRA).

iii. **Step Three**. Potential response action.

1) The decision to conduct a response action should be based on a determination of unacceptable human health risk documented through an appropriate remedy selection document (for example, a removal action memorandum or Record of Decision under CERCLA or a Corrective Measures Study, Statement of Basis,

or Corrective Measures Implementation Plan under RCRA). For discussion of potential response actions see “Technical Support Information, Section 3.”

2) At operational installations, restoration staff must coordinate results of environmental sampling with the installation’s SG when knowledge gained from environmental investigation indicates a drinking water supply may be impacted. At BRAC installations, the BEC shall coordinate with regulatory agencies as required and appropriate under the applicable cleanup framework (normally CERCLA or RCRA).

3) Programming funds for response actions will be considered at sites where the extent of release is sufficiently delineated and a human exposure pathway is complete that shows unacceptable risk to human health. Requests for funding will be prioritized using the following criteria:

    a) Applicable ERP sites that negatively impact drinking water supply wells or, based on fate and transport assessment, are expected to have an impact within five years.

    b) Applicable sites with an active pump and treat system with reinjection up gradient of an active drinking water supply well. In addition to groundwater sampling, evaluate the treatment system effluent and discharge pathway.

    c) Remaining applicable sites.

4) When characterization and pathway assessment indicate a response action is warranted, consult with AFCEC/CZR (operational installations), and AFCEC/CIB (BRAC installations) to determine how programming and execution of the response action will be accomplished.

5) Programming funds for response actions will be approved by AFCEC/CZR or AFCEC/CIB on a case-specific basis.

4. Reporting and Data Management. Operational and BRAC installations will submit data on 1,4-dioxane sampling (e.g., location and media sampled, results) to AFCEC/CZRA (ERPIMS data group). AFCEC/CZR, in coordination with AFCEC/CZTE, will validate the accuracy of the data and compliance with Air Force and DoD policies. All validated 1,4-dioxane sampling data submitted to ERPIMS and reports of potential release investigations submitted to AFCEC/CZR will be retained as part of the installation or BRAC Administrative Record.

5. Public Affairs. Development of a strategic communications plan shall begin if presence of 1,4 dioxane is confirmed at Step One. At operational installations, any communication with the public and/or the media regarding potential or confirmed 1,4-dioxane contamination shall be reviewed and approved prior to release by the BE flight and the Air Force Public Affairs office responsible for the installation in question. Any communication with the public and/or media regarding potential or confirmed 1,4-dioxane contamination at BRAC installations shall follow proper AFCEC/CIB channels. AFCEC/CZR (operational installations) and AFLOA/JACE-FSC must also review and approve communication with the public and/or the media before release. The responsible Public Affairs office shall furnish a copy of this information to SAF/PAO. Risk communication support will be considered during response planning and implementation for sites involving human exposure when appropriate. AFCEC/CZR and AFCEC/CI will develop generic communications materials that can be tailored for installation-specific situations.

Attachment1: Supporting Technical Information

1. Background. 1,4-dioxane is a cyclic ether with many current and former industrial applications. Most relevant to the Air Force ERP is the historic use as an additive to chlorinated solvent formulations, primarily TCA, to increase shelf live and prevent corrosion of metal surfaces during various degreasing operations (known to concentrate trace-level additives). 1,4-Dioxane is a listed CERCLA hazardous substance. The Office of the Secretary of Defense (OSD) Materials of Evolving Regulatory Interest Team (MERIT) Phase I assessment rated 1,4-dioxane as "high risk" to DoD Cleanup programs in 2007, and since then, the Air Force Emerging Issues Program has evaluated the potential impact of 1,4-dioxane on the Air Force ERP.

2. Regulatory Authority and Management for 1,4-dioxane. 1,4-dioxane may be regulated as either F or U coded waste under RCRA (per 40 CFR Part 261.33 and 40 CFR Part 261.31). If responding under RCRA, consult an environmental attorney. 1,4-dioxane is a "listed" CERCLA "hazardous substance" (40 CFR 302.4) and has a Reportable Quantity (RQ) under CERCLA and Emergency Planning and Community Right-to-Know Act (EPCRA). 1,4-dioxane is also regulated as a Hazardous Air Pollutant (HAP) under the Clean Air Act. RCRA corrective actions and/or CERCLA response actions require consideration of the USEPA Integrated Risk Information System (IRIS) toxicity values. The EPA 1,4-dioxane IRIS evaluation for oral exposures was finalized in 2010 and three EPA Regions have extrapolated that value into groundwater and soil screening levels. In addition, several states have established cleanup levels based on drinking water action levels and health advisories. These levels vary between 0.35 and 50 ug/L. RPMs and BECs should ensure the hierarchy of provisional toxicity values established in DoDI 4715.18 is followed when determining applicable screening and cleanup levels.

3. Remediation Technologies. Because of its physical and chemical properties (high miscibility in water and low adsorption factor), 1,4-dioxane is not amenable to conventional ex-situ treatment technologies used for chlorinated solvents, nor does it readily biodegrade in environmental media. In general, the physical properties of 1,4-dioxane promote substantial migration in groundwater from release areas. Currently, advanced oxidation processes using hydrogen peroxide with ultraviolet light or ozone are generally recognized as the most efficient remediation technologies in groundwater. Other groundwater remediation technologies such as enhanced biological degradation using ex-situ bioreactor technology or filtration treatment by granular activated carbon are technically feasible but efficiency is limited. Interim response actions to reduce risk may include plume migration control, discontinuing use of supply well(s), provision of alternate drinking water supply, land use controls, or installation of validated remediation technologies for 1,4-dioxane (e.g., advanced oxidation processes).

4. Analysis. Traditionally, the analysis of 1,4-dioxane has been performed using purge and trap techniques in conjunction with a gas chromatograph/mass spectrometer (GC/MS) (e.g., EPA Method 8260); however, because 1,4-dioxane has high water solubility, the purging efficiency is poor, leading to low recoveries, and elevated detection and quantitation limits. Other methods employing liquid-liquid extraction, vacuum distillation, and solid phase extraction yield higher recoveries as well as lower detection limits. The analysis selected will depend on programmatic and regulatory requirements, ability to achieve detection and quantitation limits that are below required regional screening levels (RSL), and site-specific considerations that may influence the analysis of the sample.

A. For drinking water samples, EPA Method 522 should be used. It employs a solid phase extraction and the gas chromatography–mass spectrometry (GC-MS) is operated in Selective Ion Monitoring (SIM) mode. Method 522 is the most sensitive of the 1,4-dioxane methods and is able to achieve the 0.67 µg/L RSL.

B. For other environmental samples (soils, groundwater, surface water), low detection limits are accomplished most often using EPA Method 8270 (a liquid-liquid extraction), in conjunction with isotope dilution and SIM mode. It should be noted that 1,4-dioxane is not in the method 8270 analyte list. Laboratories using this method can often achieve 1.0 µg/L and may be able to achieve the required RSL, although this method is not as sensitive as Method 522.

   Some labs and regulatory programs have modified the Method 522 for the analysis of groundwater. These modifications are necessary to accommodate routine groundwater sampling and preservation techniques while still adhering to procedural and quality control requirements of Method 522. Per the method, accuracy and precision data were generated in reagent water, finished ground and surface waters. Unfinished water from groundwater or surface water sources may contain matrix interferences. If Method 522 is used for these matrices, the laboratory should be consulted on their ability to achieve project required detection limits as well as any possible modifications to the method to overcome interferences.

   Another method that may achieve low quantitation limits is EPA Method 8261, which employs vacuum distillation in combination with GC/MS. However, this method is less common and few labs may be accredited for this method. Consult with AFCEC/CZTE for laboratory availability.

Table 1 – Recommended Methods for 1,4-Dioxane Analysis

Matrix	Method	Limit of Detection	Limit of Quantitation
Soil	EPA SW 846 Method 8270	0.0234 - 0.33 mg/kg	0.0667 - 0.33 mg/kg
	EPA SW 846 Method 8270SIM	0.01 - 0.05 mg/kg	0.02 - 0.1 mg/kg
	EPA SW 846 Method 8260	0.025 - 0.25 mg/kg	0.05 - 1 mg/kg

Water	EPA 522 (Approved for DW, can be used for groundwater)	<0.025 µg/L	<0.05 µg/L
	EPA SW 846 Method 8270 Modified	0.25 µg/L	1.0 µg/L
	EPA SW 846 Method 8270	0.324 - 10 µg/L	1.0 - 10 µg/L
	EPA Method 625 (Validated for waste water)	0.324 - 10 µg/L	1.0 - 10 µg/L
	EPA SW 846 Method 8270SIM	0.4 - 1 µg/L	1 - 3 µg/L
	EPA SW 846 Method 8260	1.5 - 320 µg/L	3 - 1000 µg/L
	EPA SW 846 Method 8260SIM	1 µg/L	2 µg/L

Should installation RPMs or BEs or BRAC BECs have questions or concerns regarding sample collection techniques, sample volumes required, analysis method, etc., prior to conducting 1,4-dioxane sampling, they should contact AFCEC/CZTE or the approved laboratory conducting the analyses. If groundwater sample concentrations of 1,4-dioxane are found to exceed 0.67 µg/L, they should consult with AFCEC/CZR (operational installations) or AFCEC/CIB (BRAC installations) to determine a recommended course of action. The table above lists the limit of detection (LOD) and limit of quantification (LOQ) for each recommended analytical method.

5. Risk Evaluation and Pathway Assessment. When warranted, a site-specific risk assessment will be accomplished to evaluate the extent of actual or potential exposure and risk.

A. The most current risk-based EPA Regional Screening Levels (RSL), based on recent USEPA IRIS “Tier 1” toxicity values, are appropriate for screening-level human health risk assessments. Screening levels from the EPA RSL Summary Table (November 2012) are as follows:

1. Resident soil 4.9 mg/kg
2. Industrial soil 17 mg/kg
3. Tap water 0.67 µg/L

These levels are appropriate to use for screening out applicable sites (i.e., if samples show results below these levels, one can apply the RSLs as a surrogate for site-specific risk assessment to conclude that no further action is needed). If detected levels are above these RSLs, the installation should apply the normal processes under CERCLA or RCRA (usually including a site-specific risk assessment) to determine whether response or corrective action is necessary.

B. State regulatory agencies may have also established their own advisory/guidance levels for 1,4-dioxane in drinking water, groundwater, or soil, or have set enforceable remedial objectives (e.g., 0.35 μg/L in drinking water in Colorado). Consult AFLOA/JACE-FSC for assistance in determining whether such levels are ARARs under CERCLA or enforceable via RCRA corrective action.

C. Pathway assessment shall include the development of a conceptual site model (CSM) to verify and evaluate completed exposure pathways. At a minimum, CSMs should accomplish the following:

1. Determine whether a release of 1,4-dioxane has occurred and determine if a drinking water source has been or may be impacted.

2. Verify whether any likely impacted drinking water systems on or near the Air Force installation have been sampled for 1,4-dioxane.

3. Establish through personal knowledge/interviews and record searches whether any soil or sediment potentially contaminated with 1,4-dioxane that may threaten public health, although 1,4-dioxane readily leaches through soil, has or could be used for material, topsoil, or other uses on or off the installation.

4. Review existing documentation of environmental sampling/testing and/or hydrogeological investigations conducted for other contaminants at the site and other relevant information provided by personnel. Determine the direction of groundwater flow and proximity of potential 1,4-dioxane sources to drinking water wells on and/or off the Air Force installation. Note: sampling and analysis for 1,4-dioxane has not always been accomplished during previous investigations using analytical methods with detection limits sensitive enough to detect the screening value.

5. Confirm that an actual exposure pathway exists from source to receptor.

6. Provide data to regulators and the public, as appropriate, to discuss potential exposure scenarios and pathways.

6. Remedial Investigation/Site-Specific Risk Assessment. The EPA Integrated Risk Information System (IRIS) program oral cancer and non-cancer Tier 1 toxicity values for 1,4-dioxane will be used for site-specific risk assessment purposes; however, toxicity values are the focus of significant scientific debate and are subject to change.

A. The following toxicity values are based on the US EPA IRIS assessment (as of Aug 2012):

1. Noncancer RfD 0.03 mg/kg-day

2. Oral Cancer Slope Factor 1x10-1 per mg/kg-day

B. Any site-specific risk assessment will be based on delineation of the release (extent of impact to soil and groundwater at the site) and appropriate site-specific assumptions about exposure.

C. Where a site-specific risk assessment indicates 1,4-dioxane concentrations could potentially result in unacceptable risk, the site will be prioritized for potential response action in accordance with the DoD relative risk assessment process. Risk shall be assessed using the toxicity values approved by AFCEC/CZTE in accordance with DoDI 4715.18 Enclosure 3, unless there are promulgated ARARs that dictate the use of another value. Coordinate with AFCEC/CZR (active installations), AFCEC/CIB (BRAC installations), and AFCEC/CZTE to identify the most scientifically valid and appropriate toxicity values and risk assessment methodologies.